OHMEDA INFANT WARMER

IWS u ls shipped with Serial Number HCA or higher have a electronic controlle mon to all models. This change was made to simplify servicing futur models, to incorporate changes necessary to comply with international dards, and to minimize susceptibility to EMI.

All IW its with software revision 4.01 or higher have controller board identified he presence of an eight position dip switch. Refer to Section 4.1 for calib and adjustment of this controller board.

To fa e service of IWS product with a controller board software revision prior 01 (Control Board Part No. 6600-0048-700), a separate section on Calib and Adjustment has been included. This older controller board is ident by the four position dip switch. Refer to Section 4.2 for calibration and a ment of Infant Warmers with this controller board.

**⚠WA NG: Use extreme care while performing calibration and adjustment proce s, or while working on the Infant Warmer System with power conn l. An electrical shock hazard does exist; be certain to observe all safet cautions.**

**⊗CA N: Use the Static Control Work Station (Stock No. 0175-2311-000) to help re that static charges are safely conducted to ground. The Velostat mate s conductive. Do not place electrically powered circuit boards on it.**

**Note** audio alarm will sound for about 2 seconds whenever powering up the u

**Note** m up the unit for 5 minutes before making these adjustments.

## 4.1 Co oller Calibration (Software Revision 04.01 or higher)

This on is to be used for calibration and adjustment of Infant Warmer Syste with Software Revision "4.01" or higher (i.e. control board service stock ber 6600-0223-800). Refer to Section 8 for detailed circuit diagrams.

The oller board contains an eight position dip switch. The state or configur of each switch position may change, i.e. On or Off, during the calibrati ocedure, depending on the adjustment procedure. The function of

each switch ion and the normal state is given below:

| Switch n / Function | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|
| PTG Alarm 1.0 °C | X | X | X | 0 | X | X | 0 |
| PTG Alarm 0.5 °C | X | X | X | 1 | X | X | 0 |
| RS-232 Normal Mo | X | X | X | X | X | 0 | 0 |
| RS-232 Reserved | X | X | X | X | X | 1 | X |
| Normal Operation | X | X | X | X | X | X | 0 |
| Service Loop/ RS 232 Diagnostics | X | X | X | X | X | X | 0 |
| A/D Calibration Lo | X | X | X | X | X | X | 1 |
| RS-232 Diagnostics | | | | | | | |
| Line Volt Cal Loop | X | X | X | X | X | X | 1 |
| RS-232 Diagnostic | | | | | | | |

X= no effect (but s emain in "Off" position) 0= Off 1= On

### 4.1.1 Control Access

1. Disconnec power cord for the Infant Warmer System from all outlet.
2. Remove t unting screws for the controller cover. Rem ne control-ler cover.
3. Fold the F ield down (if present), away from the contr oard.
4. Note the p ns of the test switch S1 located on the cont ard before performin operations in this section. Be sure to replace est switch to these o l positions before returning the unit to servi

### 4.1.2 Power S y Board Voltages

1. All eight p ns on test switch (S1) should be Off.
2. Connect t ntroller assembly to an appropriately rated p source (listed vol 10%), and switch the power switch On.

   **Note**: You o through the normal start up routine. Patie mperature alarms ma ger.
3. Check tha ollowing dc voltages are present at the test ector (T1) located on ontrol board. Voltages should be within the nces specified; wise follow the recommended corrective act

| Test Point | Reading | Corrective action |
|---|---|---|
| TP7 Ground ( on) | — | — |
| TP3 (9.0 Vdc | 9 ± 0.2 Vdc | adjust R4 on Po upply PCB |
| TP4 (5.0 Vdc | 5 ± 0.3 Vdc | replace Power S r PCB |
| TP5 (5.0 Vdc | 5 ± 0.3 Vdc | replace Power S r PCB |

4. If 'rective actions are required, continue with Section 4.1.3, Display B: ess, at step 2.

### 4.1.3 D y Brightness Check

**Note** display brightness is pre-calibrated at the factory and should only requ: ustment if replacing a component on the display board.

**Test Pr( 'e**

1. A t positions on controller board test switch (S1) should be Off. Connect tl troller assembly to an appropriately rated power source and switch tl /er switch On.

2. H e Alarm Silence switch down for five seconds.

3. C hat all the displays are illuminated and are of uniform brightness.

**N** VS 2001 International units do not have a control temperature display, s( .ode indicator, or probe failure indicator.

4. If splays are acceptable proceed to Section 4.1.4, Alarm Volume, at step 2. displays are not illuminated adequately proceed with the adjustment p: ıre.

**Adjustn rocedure**

**⚠CA N: The back panel and display panel may drop down when the bottc /er mounting screws are removed. Be sure to secure the panels with )efore disassembly.**

1. S\ the power switch Off and unplug the unit.

2. T: e display panel and back panel to the top cover.

3. R( the four outside corner mounting screws from the bottom of the di panel. Do not remove the two inside mounting screws. Remove the b( display cover by sliding it down.

4. F( the bottom edge of the ESD shield to access the display board. C: t a digital voltmeter across R10, located on the bottom edge of the di board.

5. C the controller assembly back to the appropriately rated power source.

6. D: and hold down the Start/Hold switch while you switch the power

switch On to enter the ADC calibration routine. "CAL" appears in the patient temperature display and "AdC" appears in the control temperature display.

7. Adjust R9 on the display board until the voltage across R10 is 3.30 ± 0.2 Vdc

8. Switch the power switch Off and then back On and verify that all segments of all displays are illuminated and are of uniform brightness.

9. Switch the power switch Off.

10. Fold the edge of the ESD shield back into place. Replace the bottom of the display panel using the four screws previously removed.

11. Continue with Section 4.1.4, Alarm Volume, at step 2.

### 4.1.4. Alarm Volume

**Note**: The alarm volume and frequency are pre-calibrated at the factory and should only require adjustment if a related control board component is replaced.

**Test Procedure**

1. All eight positions on controller board test switch (S1) should be Off. Switch the Infant Warmer On.

2. Activate the alarm by selecting the servo mode and unplugging the patient probe, or alternatively, hold down the Alarm Silence switch for five seconds (IWS 2001 International models). You should hear an intermittent tone for the first 30 seconds, followed by an alternating two tone alarm.

3. Ensure the alarm tone and volume are at the desired levels. Verify that the audio alarm level is adequate in a location with a background noise level of 55 dBA max. If the audio alarm level is acceptable, continue with Section 4.1.5, Analog to Digital Converter Calibration, at step 3. If the audio alarm level is unacceptable, continue with the adjustment procedure.

**Adjustment Procedure**

1. Switch the power switch Off.

2. All eight positions on controller board test switch (S1) should be Off. Depress and hold down the Start/Hold switch while you switch the power switch On to enter the ADC calibration routine.

3. Verify that the frequency at pin 1 of the control board test connector is 2 kHz

± 0.1 kHz. Adjust R3 on the control board as required to achieve the desired sound level.

**Note**: If test equipme t is not available for checking the 2 kHz frequency, adjust R38 for maxim m sound level.

4. Verify that R37 on th control board is set fully CW (maximum volume).

5. Continue with Sectio 4.1.5, Analog to Digital Converter Calibration.

### 4.1.5 Analog to Digital onverter (ADC) Calibration

1. Switch the power sw ch Off.

2. All eight positions on ontroller board test switch (S1) should be Off. Connect the controlle assembly to an appropriately rated power source and switch the power sw ch On and allow the unit to stabilize for 5 minutes.

3. Connect the followin resistances to the patient jack and verify the patient temperature reading

| Resistance | Swi h Setti g | Patient Temperature Display |
|---|---|---|
| 5496 Ω ± 0.1% | I | 39.0 ± 0.1 degrees |
| 7060 Ω ± 0.1% | I | 33.0 ± 0.1 degrees |
| 5900 Ω ± 0.1% | I | 37.3 ± 0.1 degrees |
| 6190 Ω ± 0.1% | I1 | 36.2 ± 0.1 degrees |

4. Depress the Apgar St rt/Hold switch for five seconds.

5. Verify that the correc values appear for the cal low and cal high resistors:

   Patient temp: 2 .0 ± 0.3°C (cal low signal; 1 decimal place)
   Control temp: 3 7.9 ± 0.3°C (cal high signal; 1 decimal place)

   **Note**: Only the cal lo reading appears on IWS 2001 International units, which do not have a c ntrol temperature display.

6. If the displayed valu are within tolerances, continue with Section 4.1.6, Line Voltage Compensati .. Otherwise, record if the temperatures differ from their target values b nore than a half degree centigrade and continue with the adjustment proc ure.

#### Adjustment Procedure

**Note**: *If the unit is co ., let it operate for five minutes before starting this* adjustment.

1. Switch the power switch Off.

2. Depress and hold down the Start/Hold switch while you switch the power switch On to enter the ADC calibration routine.

3. Connect a resistance of 5900 Ω ± 0.1% to the patient probe connector.

   **Note**: 5900 Ω ± 0.1% is switch setting I7 on the temperature simulator box.

4. If the temperature displays in the calibration check differed from the target values by less than half a degree centigrade, continue with step 5. Otherwise:

   a. Connect a voltmeter between pins 10 and 7 of the control board test connector.

   b. Set the voltage at TP10 to 2.000 Vdc by adjusting R44.

   c. Connect the voltmeter between pins 9 and 7 of the control board test connector.

   d. Set the voltage at TP9 to 0.368 Vdc by adjusting R52. Then, disconnect the voltmeter.

5. Connect a resistance of 5900 Ω ± 0.1% to the patient probe connector. Adjust R52 to obtain a reading of 37.37 ± 0.02°C in the elapsed time display.

   **Note**: The decimal point does not appear. Although the tolerance is ± 0.02°C, the readings should be adjusted as closely as possible to the nominal value; the ± 0.02°C allows for variation in measured temperature due to system noise, etc.

6. Connect a resistance of 7686 Ω ± 0.1% to the patient probe connector. Adjust R44 to obtain a reading of 31.09 ± 0.02°C in the elapsed time display.

   **Note**: 7686 Ω ± 0.1% is switch setting I1 on the temperature simulator box.

7. Repeat steps 5 and 6 until no further adjustment is required.

8. Switch the power switch Off, wait 5 seconds and switch the power switch back On.

9. Connect the following resistances to the patient probe connector and verify the correct temperature readings appear in the patient temperature display.

| Resistance | Switch Setting | Pat | Temperature Display |
|---|---|---|---|
| 5496 Ω ± 0.1% | (I2) | 39 | ).1 degrees |
| 7060 Ω ± 0.1% | (I3) | 33 | ).1 degrees |
| 5900 Ω ± 0.1% | (I7) | 37 | ).1 degrees |
| 6190 Ω ± 0.1% | (I11) | 36 | ).1 degrees |

**Note**: The resistance values shown abov e available on the Temperature Simulator. The switch positions are liste( ɔarentheses.

10. Continue with Section 4.1.6, Line Voltag mpensation.

## 4.1.6. Line Voltage Compensation

**⚠WARNING: Use extreme care while perf ing calibration and adjustment procedures, or while working on the nt Warmer System with power connected. An electrical shock haza loes exist; be certain to observe all safety precautions.**

### Test Procedure

1. Switch the power switch Off.
2. All eight positions on test switch (S1) sh( be Off.
3. Use a Digital Volt Meter and measure th( ı voltage at the wall outlet.
4. *Connect the controller assembly to an ap ɔriately rated power source* and switch the power switch On.
5. Read the corresponding percent of your ı ; nominal voltage from the following table. The outlet voltage selec' e row and the unit's nominal voltage selects the column. For example ıe line voltage measures 110 Vac for a 115 Vac nominal unit, the % no1 l voltage is 95% and 950 ± 20 should appear in the elapsed time displa' ;tep 7.

   **Note**: Record this value from the table fo1 ır use.

| Line (Outlet Voltage) | | | | % Nominal (Nom.) Line Voltage x10 |
|---|---|---|---|---|
| 95V Nom. | 115V Nom. | 220V Nom. | 230/240V Nom. | (Elapsed time display) |
| 86 | 104 | 199 | 217 | 900±20 |
| 87 | 105 | 201 | 219 | 910±20 |
| 88 | 106 | 203 | 221 | 920±20 |
| 89 | 107 | 205 | 224 | 930±20 |
| 90 | 109 | 207 | 226 | 940±20 |
| 91 | 110 | 210 | 229 | 950±20 |
| 92 | 111 | 212 | 231 | 960±20 |
| 93 | 112 | 214 | 233 | 970±20 |
| 94 | 113 | 216 | 236 | 980±20 |
| 95 | 115 | 220 | 240 | 1000±20 |
| 96 | 117 | 223 | 243 | 1010±20 |
| 97 | 118 | 225 | 245 | 1020±20 |
| 98 | 119 | 227 | 248 | 1030±20 |
| 99 | 120 | 229 | 250 | 1040±20 |
| 100 | 121 | 232 | 253 | 1050±20 |
| 101 | 122 | 234 | 255 | 1060±20 |
| 102 | 124 | 236 | 257 | 1070±20 |
| 103 | 125 | 238 | 260 | 1080±20 |
| 104 | 126 | 240 | 262 | 1090±20 |
| 105 | 127 | 243 | 265 | 1100±20 |

6. Depress the Start/Hold switch for five seconds.

7. Verify that the value in the elapsed time display equals the percent of nominal voltage read from the table in step 5.

8. If the displayed values are within tolerances, continue with Section 4.3, Oxygen/Air Regulator Checks and Adjustments. Otherwise, continue with the adjustment procedure below.

**Adjustment Procedure**

1. Switch the power switch Off.

2. Depress and hold down the Reset switch while you switch the power switch On to enter the % Line Voltage Calibration routine.

3. Slowly adjust R3 on power supply board as required until the elapsed time display equals the value read from the table in step 5 of the test procedure.

4. Continue with Section 4.3, Oxygen/Air Regulator Checks and Adjustments.

## 4.2 Controller Calibration (Prior to Software Revision 04.01)

This section has been included to facilitate service of IWS product with controller board with a Software Revision prior to 4.01. Refer to Section 8 for a detailed circuit diagram.

This controller board is identified by the presence of a four position dip switch; controller boards with software revision 4.01 or higher have an eight position dip switch. This board is no longer available. If this board fails the calibration and adjustment section, the board should be replaced. When replacing this board order controller service kit:

6600-0360-800 EMI Noise Suppression Kit for English IWS Models
6660-0360-801 EMI Noise Suppression Kit for French IWS Models
6600-0360-802 EMI Noise Suppression Kit for Spanish IWS Models
6600-0360-803 EMI Noise Suppression Kit for German IWS Models
6600-0360-804 EMI Noise Suppression Kit for Spanish IWS 2001 Models
6600-0360-805 EMI Noise Suppression Kit for French IWS 2001 Models
6600-0360-806 EMI Noise Suppression Kit for English IWS 2001 Models

Each controller service kit includes EMI shielding to minimize susceptibility of the replacement controller board to electrostatic discharge, power line conducted noise and radiated electromagnetic interference. See page 7-80 for a list of the kits contents.

The earlier version controller board contains a four position dip switch. The setting of each switch position may change (On or Off) during the calibration procedure, depending on the adjustment procedure being performed.

| | Dipswitch Position | | | |
|---|---|---|---|---|
| | 1 | 2 | 3 | 4 |
| PTG Alarm 1.0 degree | 0 | 0 | 0 | 0 |
| PTG Alarm 0.5 degree | 1 | 1 | 0 | 0 |
| Cal Display Loop | 0 | 0 | 1 | 0 |
| Cal ADC Loop | 0 | 0 | 0 | 1 |
| Triac Test Loop | 0 | 1 | 1 | 1 |
| Service Loop | 1 | 1 | 1 | 1 |
| | 0 = Off | | 1 =On | |

## 4.2.1 Power Supply Board Voltages

1. Configure the four position test switch (S1) located on the control board as follows:

   Switch #1,#2, #4 Open (Off)
   Switch #3 Closed (On)

2. Connect the controller assembly to an appropriately rated power source (listed voltage + 10%), and switch the power switch On.

   **Note**: *You will go through the normal start up routine. Patient temperature* alarms may trigger.

3. Check that all display segments are On, the observation lamp is On, the alarm light is On, the heater radiates heat, and a continuous alarm tone sounds.

4. Check that the following dc voltages are present at the test connector (T1) located on the control board. Voltages should be within the tolerances specified; otherwise follow the recommended corrective action:

| Test Point | Reading | Corrective action |
|---|---|---|
| TP7 Ground (common) | — | — |
| TP3 (9.0 Vdc ST.) | 9 ± 0.2 Vdc | adjust R4 on Power Supply PCB |
| TP4 (5.0 Vdc LEDS) | 5 ± 0.3 Vdc | replace Power Supply PCB |
| TP5 (5.0 Vdc ST.) | 5 ± 0.3 Vdc | replace Power Supply PCB |

5. If no corrective actions are required, continue with Section 4.2.3, Display Brightness, at step 2.

## 4.2.2 Display Brightness Check

**Note**: The display brightness is pre-calibrated at the factory and should only require adjustment if replacing a component on the display board.

### Test Procedure

1. Configure the four position test switch (S1) on the control board as follows:

   Switch #1, #2, #4 Open (Off)
   Switch #3 Closed (On)

   Connect the controller assembly to an appropriately rated power source and switch the power switch On.

2. Check that all the displays are illuminated and are of uniform brightness.

   **Note**: IWS 2001 International units do not have a control temperature display.

3. If the displays are acceptable proceed to Section 4.2.4, Alarm Volume, at step 2. If the displays are not adequately illuminated, proceed with the adjustment procedure.

### Adjustment Procedure

**⚠CAUTION: The back panel and display panel may drop down when the bottom cover mounting screws are removed. Be sure to secure the panels with tape before disassembly.**

1. Switch the power switch Off and unplug the unit.
2. Tape the display panel and back panel to the top cover.
3. Remove the four outside corner mounting screws from the bottom of the display panel. Do not remove the two inside mounting screws. Remove the bottom display cover by sliding it down.
4. Connect a digital voltmeter across R10, located on the bottom edge of the display board.
5. Connect the controller assembly to an appropriately rated power source.
6. Turn On the power switch leaving the test switch S1 settings unchanged from step 1 of the Test Procedure Section above.
7. Adjust R9 on the display board until the voltage across R10 is 3.30 ± 0.2 Vdc.
8. Verify that all segments of all displays are illuminated and are of uniform brightness.
9. Switch the power Off.
10. Replace the bottom of the display panel using the four screws previously removed.

### 4.2.3 Alarm Volume

**Note**: The alarm volume and frequency are pre-calibrated at the factory and should only require adjustment if a related control board component is replaced.

**Test Procedure**

1. All four positions on test switch (S1) on the controller board should be Off. Switch the power switch On.
2. Activate the alarm by selecting the servo mode and unplugging the patient probe, or alternatively, hold down the Alarm Silence switch for five seconds (IWS 2001 International models). You should hear an alternating two tone alarm.
3. Ensure the alarm tone and volume are at the desired levels. Verify that the audio alarm level is adequate in a location with a background noise level of 55 dBA max. If the audio alarm level is acceptable, continue with Section 4.2.5, Analog to Digital Converter Calibration, at 4.2.4. If the audio alarm level is unacceptable, continue with the adjustment procedure.

**Adjustment Procedure**

1. Switch the power switch Off.

2. Positions #1, #2 and #4 on test switch (S1) on the controller board should be Off. Position #3 should be On. Switch the power switch On.

3. Verify that the frequency at pin 1 of the control board test connector is 2 kHz ± 0.1 kHz. Adjust R38 on the control board as required.

   **Note**: If test equipment is not available for checking the 2 kHz frequency, adjust R38 for maximum sound level.

5. Verify that R37 on the control board is set fully CCW (maximum volume).

6. Continue with Section 4.2.5, Analog to Digital Converter Calibration, at step 4.

## 4.2.4 Analog to Digital Converter (ADC) Calibration

1. Switch the power switch Off.

2. Configure the four position test switch (S1) on the control board as follows:

   | | |
   |---|---|
   | Switch #1, #2, #3 | Open (Off) |
   | Switch #4 | Closed (On) |

3. Connect the controller assembly to an appropriately rated power source and switch the power switch On and allow the unit to stabilize for 5 minutes.

4. Connect a resistance of 5900 Ω ± 0.1% to the patient probe connector.

   **Note**: 5900 Ω ± 0.1% is switch setting I7 on the temperature simulator box.

5. Verify that the ADC counts displayed on the elapsed time display is 1122 ± 2 counts. Slowly adjust R44 on control board as required.

6. Connect the following resistances to the patient probe connector and verify the correct temperature readings appear in the patient temperature display.

| Resistance | Switch Setting | Patient Temperature Display |
|---|---|---|
| 5496 Ω ± 0.1% | (I2) | 39.0 ± 0.1 degrees |
| 7060 Ω ± 0.1% | (I3) | 33.0 ± 0.1 degrees |
| 5900 Ω ± 0.1% | (I7) | 37.3 ± 0.1 degrees |
| 6190 Ω ± 0.1% | (I11) | 36.2 ± 0.1 degrees |

**Note**: The resistance values shown above are available on the Temperature Simulator. The switch positions are listed in parentheses.

10. If the displayed values are within tolerances, continue with Section 4.2.5, Line Voltage Compensation. If not, replace the control board.

## 4.2.5 Line Voltage Compensation

⚠**WARNING: Use extreme care while performing calibration and adjustment procedures, or while working on the Infant Warmer System with power connected. An electrical shock hazard does exist; be certain to observe all safety precautions.**

**Test Procedure**

1. Switch the power switch On.

2. Press and hold the hidden switch on the control panel located directly above the alarm silence switch.

3. After two seconds the display should indicate as follows:

   a. Patient Temperature displays 25.0 ± 0.1°

   b. Control Temperature displays 37.9 ± 0.1°

   c. Elapsed Time displays % nominal line voltage ± 2%

4. Switch the power switch Off and unplug the power cord from the wall outlet.

5. Use a digital volt meter and measure the line voltage at the wall outlet.

6. Connect the controller assembly to an appropriately rated power source and turn the power switch On.

7. Read the corresponding percent of your unit's nominal voltage from the following table. The outlet voltage selects the row and the unit's nominal voltage selects the column. For example, if the line voltage measures 110 Vac for a 115 Vac nominal unit, the % nominal voltage is 95% and 95 ± 2 should appear in the control temp display in step 8.

   **Note**: Record this value from the table for later use.

| Line (Outlet Voltage) | | | | % Nominal (Nom.) Line Voltage x10 |
|---|---|---|---|---|
| 95V Nom. | 115V Nom. | 220V Nom. | 240V Nom. | (Elapsed time display) |
| 86 | 104 | 199 | 217 | 90±2 |
| 87 | 105 | 201 | 219 | 91±2 |
| 88 | 106 | 203 | 221 | 92±2 |
| 89 | 107 | 205 | 224 | 93±2 |
| 90 | 109 | 207 | 226 | 94±2 |
| 91 | 110 | 210 | 229 | 95±2 |
| 92 | 111 | 212 | 231 | 96±2 |
| 93 | 112 | 214 | 233 | 97±2 |
| 94 | 113 | 216 | 236 | 98±2 |
| 95 | 115 | 220 | 240 | 100±2 |
| 96 | 117 | 22 | 243 | 101±2 |
| 97 | 118 | 225 | 245 | 102±2 |
| 98 | 119 | 227 | 248 | 103±2 |
| 99 | 120 | 229 | 250 | 104±2 |
| 100 | 121 | 232 | 253 | 105±2 |
| 101 | 122 | 234 | 255 | 106±2 |
| 102 | 124 | 236 | 257 | 107±2 |
| 103 | 125 | 238 | 260 | 108±2 |
| 104 | 126 | 240 | 262 | 109±2 |
| 105 | 127 | 243 | 265 | 110±2 |

8. Verify that the value in the elapsed time display equals the percent of nominal voltage read from the table in step 7.

9. If the displayed values are within tolerances, continue with Section 4.2.6, Safety Circuit Test. Otherwise, continue with the adjustment procedure.

**Adjustment Procedure**

1. Slowly adjust R3 on power supply board as required until the elapsed time display equals the value read from the table in step 5 of the test procedure.

2. Continue with Section 4.2.6, Safety Circuit Test.

### 4.2.6 Safety Circuit Test (Prior to Software Revision 03.11)

1. Configure the four position test switch (S1) located on the control board as follows:

   Switch #1 Open (Off)
   Switch #2, #3, #4 Closed (On)

2. Switch the power switch On.

3. The front panel should display the following:

| | |
|---|---|
| Pat. Temp. | EEE |
| Cont. Temp. | EEE |
| Elapsed Time | Running in Stop Watch Mode |

4. Confirm that the heat indicator LED on the control board is illuminated.

5. Use a stop watch and verify that elapsed time display is accurate within ± 1 second per minute.

6. After approximately 3 minutes and 20 seconds (for 60 Hz models) or approximately 4 minutes (50 Hz models) a two tone alarm occurs which cannot be silenced.

7. Confirm the heat indicator LED on the control circuit board (viewed from the rear of unit) is Off.

8. Switch the power switch Off and restore the test switch to the original configuration (all switches Open).

### 4.2.7 Triac Safety Circuit Test (Rev 03.11 Software Only)

1. Place the individual test switches in the following positions:

   Switch #1 Open ("Off")
   Switch #2,#3, #4 Closed ("On")

2. Switch the power switch on.

3. The front panel should display the following:

| | |
|---|---|
| Pat Temp | EEE |
| Cont Temp | EEE |
| Elapsed Time | Running in stop watch mode. |

4. Let run until the display indicates 03:10 (3 minutes 10 seconds) for 60 hertz units or 03:50 (3 minutes 50 seconds) for 50 hertz units.

   **Note**: The elapsed timer may reset back to 00:00 and restart timing and the audio alarm activate for 1 second before the time elapses. If so wait until the timer gets back to 03:10 or 03:50.

5. Confirm that the heat indicator LED on the control board is lit.

6. Let the unit run until a warbling two tone alarm which cannot be silenced occurs (5 minutes maximum time).

7. Confirm the elapsed timer stops between 03:10 and 03:40 for 60 hertz units (03:50 and 04:20 for 50 hertz units). If outside this range or if E 08 is displayed then the control board is defective.

8. Confirm that the heat indicator on the control board is off. If not replace the control board.

9. Switch the power switch Off and restore the test switch to the original configuration (all switches Open).

## 2.8 Test Loop

### ɔmplete Unit Testing

1. Switch the power Off.

2. Configure the four position test switch S1 on the control board in the test loop position. All switches Closed (On).

3. Switch the power switch On.

4. Verify that the following sequence occurs:

   a. For the first second:

      All segments, LEDS, and high-low alternating tone audible alarm are On.

   b. For the next second:

      High-low alternating tone audible alarm On. Patient display "60H" for 60 Hz ("50H" for 50 Hz).

      Elapsed time display - software revision number.

   c. The unit should then loop in the following order until the power is removed:

| Seven Seg Display's | Bar Graph Segments | Alarm LEDs | Mode LEDs | Heater and Lights |
|---|---|---|---|---|
| All 1's | 1,11 | *Probe fail | *Servo | On |
| All 2's | 2,12 | Pat. temp. | *Servo | Off |
| All 3's | 3,13 | Sys. fail | *Servo | On |
| All 4's | 4,14 | Heater Off | Manual | Off |
| All 5's | 5,15 | Reset timer | Manual | On |
| All 6's | 6,16 | Spare LED | Manual | Off |
| All 7's | 7,17 | All Off | Apgar | On |
| All 8's | 8,18 | All Off | Apgar | Off |
| All 9's | 9,19 | All Off | Apgar | On |
| All 0's | 10,20 | All Off | All Off | Off |
| All Off | All Off | All Off | All Off | Off |

* LED indicators not present on IWS 2001 International units.

While looping through this test loop the program also does RAM tests, memory checksum, and ADC calibration tests. If any error occurs, an error number will be displayed in the Elapsed Time display and the critical alarm will sound for 2 seconds. The program will then continue to loop and display any additional error numbers. See Section 6 for error code descriptions.

5. Switch the power switch Off and restore the test switch to the original configuration (or all switches Open).

   For patient temperature alarm-difference setting greater than 0.5 degree C:

   Switch #1, #2 should be closed (On)
   Switch #4 should be open (Off).

6. Replace the back panel.

**Controller Unit Testing Separate From Warmer**

**Note**: If required, the controller unit can be tested separately from the warmer. The following test load may be connected in place of a heater assembly.

1. With the power switch Off connect the controller assembly to a test load as follows:

2. Between J17 pin 3 (phase) and J17 pin 1 (heater N) connect a 400 watt resistive load for 115 Vac.

3. Between J17 pin 3 and J17 pin 2 (alarm light N) connect a 12 watt resistive load for 115 Vac.

4. Between pin 1 and pin 3 of the observation light connector, place a 50 watt resistive load for 12 Vac.

## 4.3 Gas Regulator Check and Adjustment

Check the output pressure of the regulators. If adjustment is required perform the adjustment procedure.

**Gas Regulator Pressure Check** (See Figure 5-24)

1. Disconnect the gas pipeline connection(s).

2. Check system for leaks according to section 5.8 F. Remove the cylinder(s). Bleed off the cylinder pressure.

3. Remove the mounting screws for the Gas Yoke and Regulator Assembly and then remove the assembly.

4. Disconnect the copper tubi: om the outlet port o regulator(s).

   **Note**: The regulator(s) outpu ssure must be 52 ± 2 (4 bar ± 138 millibar in the U.K.) with approximat 00 cc per minute flov sing through it.

5. Attach the special fitting a uge assembly (Stoc 0175-0543-000) to the regulator outlet. This s l tool has a 0.025 in. ce to maintain an approximately 500 cc per n e flow for proper re or adjustment.

6. Attach a gas cylinder to the e and open the cylir valve.

7. Check the pressure gauge t ermine if the regul s set correctly.

**Gas Regulator Adjustment Proce**

1. If required, adjust the regul adjustment screw u he special fitting pressure gauge reads 52 ± 2 f (4 bar ± 138 milliba ie U.K.). If present, adjust other regulator.

2. Tighten the adjustment scr ck nut. Re-check th ssure.

3. Close the gas cylinder valve remove the gas cyl from the yoke.

4. Remove the special fitting a auge assembly.

5. Reconnect the copper tubin he regulator outlet.

6. Place the Gas Yoke and Reg r Assembly in posit n the warmer and replace the eight mounting s vs for the assembly

7. Check system for leaks accordi section 5.8 F. Bleed off ylinder pressure.

## 4.4 Electrical Safety Ch

### A. Leakage Current

Use approved equipment and t ques to test the un akage current and ground continuity. Follow the d ons supplied by the equipment manufacturer to verify the following:

1. Less than 100 microamperes sured at any expos etal surface for equipment rated at 120 Vac, 0 Hz.

2. Less than 200 microamperes r ired at any exposed l surface for equipment rated at 220 Vac, 50/60 l 0 Vac, 50/60 Hz or 2 c, 50/60 Hz.

)n elevating models, repeat the leakage current test while raising and ɔwering the bed to ensure that the leakage current remains within limits

### ;round Resistance Check

a low range ohmmeter or electrical safety analyzer to measure the resis- :e between the ground pin on the line cord plug and exposed metal of the mer. The ground resistance must be less than 0.1 ohms.

ɜ: Higher readings may indicate loose or oxidized connections in the power . or grounding circuits.

## 4 ed Motor Raise and Lower Test (Elevating Models Only)

'ress the Raise Bed switch.

. Ensure that the bed elevates smoothly.

. Ensure that the motor continues operating with a over ridding clutch action at the upper limit (~46-1/2 inches, or 118 cm, from the top of the mattress to the floor).

ress the Lower Bed switch.

. Ensure that the bed lowers smoothly.

. Ensure that the motor continues operating with a over riding clutch action at the lower limit (~38-1/2 inches, or 98 cm, from the top of the mattress to the floor).

**ıCAUTION: On elevating models, do not continue run the motor at pper and lower limit positions; equipment damage may result.**